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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
08/988,246	12/01/1997	SEBASTIEN RAOUX	AM1771-4-T19	7250

32588 7590 10/29/2002

APPLIED MATERIALS, INC.
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EXAMINER

ZERVIGON, RUDY

ART UNIT	PAPER NUMBER
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1763

37

DATE MAILED: 10/29/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

AG-37

Office Action Summary

Application No.

08/988,246

Applicant(s)

RAOUX ET AL.

Examiner

Rudy Zervigon

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 22 July 2002.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 3,4,6,11-14,16,19,20,23,24 and 26-30 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

- 5) ☐ Claim(s) _____ is/are allowed.

- 6) ☒ Claim(s) 3,4,6,11-14,16,19,20,23,24 and 26-30 is/are rejected.

- 7) ☐ Claim(s) _____ is/are objected to.

- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.

- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☐ All b) ☐ Some * c) ☐ None of:

1. ☐ Certified copies of the priority documents have been received.

2. ☐ Certified copies of the priority documents have been received in Application No. _____.

3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)

- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____.

- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.

- 5) ☐ Notice of Informal Patent Application (PTO-152)

- 6) ☐ Other: _____.

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DETAILED ACTION

1. In view of the appeal brief filed on July 22, 2002, PROSECUTION IS HEREBY REOPENED. A new ground of rejection is set forth below.

To avoid abandonment of the application, appellant must exercise one of the following two options:

(1) file a reply under 37 CFR 1.111 (if this Office action is non-final) or a reply under 37 CFR 1.113 (if this Office action is final); or,

(2) request reinstatement of the appeal.

If reinstatement of the appeal is requested, such request must be accompanied by a supplemental appeal brief, but no new amendments, affidavits (37 CFR 1.130, 1.131 or 1.132) or other evidence are permitted. See 37 CFR 1.193(b)(2).

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Claim Rejections - 35 USC § 103

1. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.
2. Claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao et al (U.S.Pat. 6,051,286) in view of Patrick et al (U.S.Pat. 5,474,648). Zhao et al teaches:
 - i. A substrate processing system (30, Figure 2, 15) using a deposition chamber (item 11, Figure 2, 15; column 29, line 58 - column 30, line 22) encasing a reaction zone
 - ii. A substrate processing system using a substrate holder (202/206, Fig.15) as a low frequency (LF) electrode (column 29, lines 60-65)
 - iii. A gas distribution system (89, Figure 1A) including a gas inlet manifold ("showerhead", 40, Figure 1A; col.29, lines 60-65) for supplying one or more process gases to the reaction zone
 - iv. The gas inlet manifold comprising a high frequency (HF) electrode ("showerhead"; item 205, Figure 15; column 29, lines 60-65)
 - v. A plasma power source (items 222, 225, Figure 15; column 29, line 65 - column 30, line 10) for forming plasma within the reaction zone of the deposition chamber, the plasma power source comprising high frequency power supply (222) coupled to the HF electrode (205) and a low frequency power supply (220) coupled with the LF electrode (206)
 - vi. Matching networks (227, 228; Figure 15; column 30, lines 17-22) for each of the low frequency and high frequency electrodes respectively - Zhao further teaches the matching

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network 228 electrically coupled to a high frequency RF generator (222) and the gas manifold (205). Zhao does not teach capacitors in the matching networks. However, matching networks are well known in the art as having capacitors as demonstrated by Patrick et al (see variable capacitors 106, 108 of matching network 120, Figure 2A)

Zhao et al does not teach an impedance monitor comprising a first impedance probe electrically coupled to the high frequency electrode to measure the impedance at the HF electrode and a second impedance probe electrically coupled to the low frequency electrode to measure the impedance at the LF electrode

Patrick et al teaches an impedance monitor (202, "RF Parameter Sensor", Figure 2A; column 7, lines 14-20) comprising a first impedance probe electrically coupled to an electrode to measure the impedance at the electrode. The monitor further measures the voltage, current, and phase angle at the chamber electrode (items 112 and 114; column 6, line 64), and measures the "impedance of the plasma chamber electrode" (column 3, lines 64-67).

12, 13, 14, 19 - Patrick et al additionally teach variable capacitors and tuners (items 106 and 108; Figure 2A; Page 28, line 6 of Applicant's Specification) of a matching network (120, Fig.2A). Patrick's variable capacitor is electrically coupled to the one of the plasma electrodes (112) and controllably coupled to the processor (204, column 7, lines 4-12) wherein the processor adjusts a

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capacitance level of the variable capacitor to vary the impedance of the plasma in response to an output of the impedance monitor.

Patrick et al further teaches a processor (204, Figure 2A) coupled with the impedance monitor (202; column 4, lines 35-40) for adjusting processing conditions (column 4, lines 2-18) of the deposition chamber based on measurements by the impedance probe.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the Patrick impedance monitor coupled to each of the low and high frequency electrodes of Zhao et al.

Motivation for using the Patrick impedance monitor electrically coupled to each of Zhao's low and high frequency electrodes is directed to providing a chamber impedance measurement and control for uniform processing as taught by Patrick (column 5, lines 57 – column 6, line 33).

3. Claims 5, 27, and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao et al (U.S.Pat. 6,051,286) in view of Patrick as applied to claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 above, and further in view of Boys et al (U.S.Pat.4,500,408). Zhao et al and Patrick et al do not teach a pressure control system based on measured plasma attributes such as impedance. Boys et al describe plasma coating apparatus controlled in response to measurements

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of plasma parameters to control deposition parameters (abstract). Specifically, Boys et al describe:

- vii. a pressure control system (column 12, lines 51-53) configured to control a pressure level within the chamber and controllably coupled to the processor wherein the processor controls the pressure control system to vary the pressure within the chamber in response to the measured impedance level of the plasma (column 22, lines 61-66)

Boys et al additionally teach a plurality of impedance measuring devices as manifested by plasma voltage and plasma current measurements (items 45, 46; Fig.1; column 11, lines 43-45).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to implement the pressure control system as described by Boys et al to be an obvious extension to the Patrick et al impedance data collection and control system.

Motivation for implementing the pressure control of Boys et al based on measuring the plasma impedance as part of the Patrick et al impedance data collection and control system is directed "To control deposition rate and coating distribution accurately over a period of time, it is necessary to control both plasma voltage and plasma current for a specific plasma power. Plasma voltage and plasma current are a function of plasma impedance.....Thus the two variables that can be varied to control plasma impedance are the pressure of the working gas in volume 13 and

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the magnetic field applied by cathode assembly 17 to target 15 and volume 13." (Column 11, lines 40-45; lines 56-59).

2. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Zhao et al (U.S.Pat. 6,051,286) and Patrick et al (U.S.Pat. 5,474,648) as applied to claims 3, 4, 6, 11-14, 16, 19, 20, 24, 26, 28, and 29 above, and further in view of in view of Yamagata et al (USPat. 5,362,358). Neither Zhao nor Patrick teach a variable capacitor separate from the matching network.


Yamagata teaches a variable capacitors (24, 26, Figure 6) separate from the matching network (22) of a plasma processing chamber.

It would have been obvious to one of ordinary skill in the art at the time the invention was made for Patrick to add a variable capacitor separate from the matching network of a plasma processing chamber as taught by Yamagata.

Motivation for Patrick to add a variable capacitor separate from the matching network of a plasma processing chamber as taught by Yamagata is discussed by Yamagata as drawn to controlling the amount of power applied to each of the electrodes in the plasma reactor (column 1, lines 45-47).

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Examiner Rudy Zervigon whose telephone number is (703) 305-1351. The examiner can normally be reached on a Monday through Thursday schedule from 8am through 7pm. The official after final fax phone number for the 1763 art unit is (703) 872-9311. The official before final fax phone number for the 1763 art unit is (703) 872-9310. Any Inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Chemical and Materials Engineering art unit receptionist at (703) 308-0661. If the examiner can not be reached please contact the examiner's supervisor, Gregory L. Mills, at (703) 308-1633.



**JEFFRIE R. LUND
PRIMARY EXAMINER**